products.[8] This conjecture is supported by the fact that the current monopoly of QUALCOMM's OmniTRACS services incorporates equipment and service costs significantly above that of a Little LEO provider of substitutable services (i.e., $ 3,000 for subscriber equipment and $ 80 per month: see the relevant entry in *Table 2: Data Networks*.)

In general, near real-time services tend to be separate markets because in most cases the value enhancement achieved by the ability to have near-real time communications dwarfs the service cost imposed for the capability. This added value can be represented in examples that involve safety of human life as well as those that incorporate high value assets. As a specific example consider the following: An automobile is driving at night on a country road. It loses control sliding into a telephone pole, deploying the airbag and rendering the driver unconscious. The auto is equipped with a Little LEO terminal that sends an alarm upon deployment of the airbag indicating both that the auto has had an accident as well as the location of the vehicle. This information is forwarded to a local emergency response service. The driver of this car purchased the Little LEO capability as an option for under $500 with an annual service charge of $25. It is unlikely that this buyer would switch to a product that may entail life endangering delays in communication of 30 minutes or more if presented with an increase in the service price of 10% *(i.e.,* an increase in the annual service charge of $ 2.50).

---

[8] The relevant markets may even be smaller than this if the hypothetical monopolist likely would discriminate in prices charged to different groups of buyers, distinguished, for example, by their uses or locations. Such potential price discrimination is not unlikely between buyer groups within many of the markets identified above, so that a more detailed analysis could well delineate different relevant markets corresponding to each such buyer group. Buyer groups can be defined based on their niche application in addition to timeliness and coverage requirements.

Similarly, high value assets such as remote pipelines or industrial sites today often utilize high-cost monitoring capabilities using geosynchronous satellites or elaborate specialized terrestrial networks. These applications deal with assets of sufficient value to dwarf the cost of a monitoring capability. The incorporation of a low cost Little LEO capability will simultaneously generate significant consumer surplus and create a hypothetical monopoly.

V.   IDENTIFYING SUPPLIERS

Once a relevant market is defined, the next task is to determine which firms are participants in that market. Under the *Guidelines*, participants include not only firms that are selling that product in that geographic configuration, but also any other firm that would be likely to enter rapidly in response to a "small but significant and nontransitory" price increase, without incurring significant sunk costs of entry or exit (i.e., firms capable of "hit and run" entry).

The columns in Table 1 list all potential service providers based on their ability to address the performance requirements of each market segment, where performance is defined exclusively as a technical capability. Each of these potential service providers is described in detail in *Table2: Data Networks* (attached at the end of this document), along with Leo One USA management's analysis of their target markets and geographic coverage. Once a market segment is determined to have one or more data networks technically capable of addressing the service requirements we further differentiate between providers based on service cost to the customer.

As Table 1 indicates, there are a number of markets in which Little LEOs will face competitive alternatives in the form of Big LEO systems, GEO systems or terrestrial systems.[9] Effective participants in a market are those whose costs are low enough that they could be expected to be able to survive in a market where competing Little LEO systems had driven prices down to competitive levels in a Little LEO market. From the data in Table 2, we identify individual suppliers (or types of suppliers, such as broadband PCS that may include multiple individual suppliers) with costs of equipment of less than $ 500, and monthly service charges of less than $ 30.[10] Such suppliers are designated with an "L" in Table 1 for "low cost". Firms which would be likely to be able to enter and remain in the market only at prices significantly above that level, but still below the level that a Little LEO that had a monopoly in that market would choose to set, (identified from Table 2, using the criteria that cost of equipment be between $ 500 and $ 1000, and cost of service between $ 50 and $ 80) are designated with an "M" for "medium cost". Even if such firms do not enter the market, their presence on the wings may constrain pricing by a Little LEO monopolist. Firms which enter and remain in the market only at prices above those levels --- levels likely to be what a Little LEO firm that was the only supplier of Little LEO services in that market would find profit maximizing -- are denoted by an "H" for high cost. Their presence would not be likely to deter even monopoly pricing by a Little LEO firm that was the only supplier in that market.

---

[9] Table 2 may well not have captured every provider in the urban pockets of coverage, but enough are represented to conclude that the market is competitive and therefore the inclusion of any additional firms would not change the results.

[10] The Data Network Table contains information from both Leo One's analysis and from a recent study by MTA-EMCI, "The US Mobile Data Market: 1995."

In addition to describing a market participant by its relative cost we indicate the status of the service provider, by denoting with a capital letter L, M, or H, those systems in which a customer could purchase service today. Systems that are planned but are not in widespread operation with service available to customers today are identified with a small letter l, m, or h, as appropriate.

In identifying participants in a market, it is important, however, not to include producers of complements as opposed to substitutes. For example, while both steel firms and iron ore firms might be described as being in the steel business or at least in related businesses, steel production and iron ore production are complements, not substitutes. Steel and iron ore are therefore in different markets, and a firm that was the only producer of steel would still be a monopolist in the steel market even if there were hundreds of iron ore firms. Stated differently, a competitive iron ore industry would not constrain prices -- and indeed would encourage even higher prices -- charged by a steel monopolist. A more complex example that is more similar to this case is provided by cellular and wireline services, which are generally regarded as essentially complementary. Even a large increase in wireline prices would not induce large numbers of customers to switch to exclusively cellular service. In addition, cellular prices that are much higher than wireline can be maintained because cellular essentially fills in a gap in wireline service. Thus even if, at some low enough price, cellular could be a close substitute for wireline, wireline would not be a close substitute for cellular even at a very high price for cellular.

Similarly, in many of the markets identified in Table 1, the services provided by a Little LEO supplier are more likely to be a complement than a substitute for several of the services provided by

14

other (non-Little LEO) suppliers.[11] In the nationwide, non-ubiquitous truck dispatch and monitoring

tracking market, for example, Ram Mobile Data and Ardis may be sufficiently low cost to compete

effectively with a Little LEO system, and even exclude Little LEO services from some (*e.g.*, urban)

markets entirely, but their coverage is limited to urban areas. Customers desiring nationwide service,

therefore, may find it most economic to combine services from either of these two suppliers with that

of a Little LEO. Alternatively, a firm such as Ram Mobile Data may decide to purchase services

from a Little LEO in order to fill in the gaps in its coverage and offer a nationwide service. It may

even be the case that a Little LEO system will choose to buy services from firms such as Ram

---

[11]   For example, ORBCOMM's Offering Memorandum (ORBCOMM Global, L.P. (and) ORBCOMM Global Capital Corp., *Offering Memorandum*, Bear, Stearns & Co. Inc. *et. al.*, August 2, 1996, hereinafter referred to as "ORBCOMM") states that :

> The company expects that in the United States, The ORBCOMM system will complement existing and planned terrestrial wireless communications systems, by providing coverage in geographic areas where such services are not offered or by enhancing data applications currently being provided through PSTN or the PSDN. (ORBCOMM, p.42)

and:

> The ORBCOMM system is not intended to compete with existing and planned terrestrial messaging and data systems. Rather, the Company believes that the ORBCOMM System will complement these system, which provide low- cost services primarily in metropolitan areas, where subscriber densities justify construction of radio towers. Such systems generally do no have sufficient coverage outside metropolitan areas, making them less attractive to vertical markets such as field service operations and trucking, where assets spend large portions of their operating time outside terrestrial system coverage areas. The ORBCOMM System presents an attractive complement to tower-based services because it can provide geographic gap-filler service at affordable cost without the need for additional infrastructure investment. (ORBCOMM, p. 50)

Mobile Data, combine them with Little LEO services, and market the final product.[12] As another example, Ardis may decide to purchase services from a Little LEO in order to fill gaps in coverage and offer a nationwide ubiquitous service. Alternatively, a Little LEO may choose to buy service from an Urban provider such as Ardis and combine the two as a final market product. Such firms are denoted in Table 1 with the addition of a small "c", a designation that can stand (corresponding to each of the above three scenarios, respectively) for either a complement, a customer, or a supplier. These firms are not, therefore, participants in the relevant market.[13]

Finally, as mentioned above, several of the columns refer to types of technologies (*e.g.*, broadband PCS) rather than individual suppliers (*e.g.*, Ram Mobile Data). In our analysis of the effect of the entry of Leo One USA, or any other Little LEO system, into those markets, we have assumed that the share of Little LEO systems in those markets would be small enough, and the number of competing suppliers from each of these alternative types of technologies would be large enough, that these markets would already be highly competitive. If, in addition, the services offered by Little LEO systems and by these alternative types of technologies were sufficiently homogeneous, entry by one or more Little LEO supplier(s) would not be expected to have a significant effect on prices or the welfare of consumers in those markets. As discussed below, this is clearly an over

---

[12]   Indeed, given that Little LEO systems will be global, it seems more likely that it will be the Little LEO system that will purchase more localized services to put together nationwide and global services. This seems to be particularly likely behavior for Leo One USA given its heritage in marketing and consumer service. In this, they stand in marked contrast to Orbcomm and other applicants whose heritage lie upstream at the satellite manufacturing and launch stage, and for whom their Little LEO operations may be viewed essentially as a way to foster markets for their upstream launching and satellite.

[13]   This would be the case even if the demand for Little LEO services would be, on balance, higher if that firm disappeared. The critical question is whether, even with that firm present in the market, there exists a distinct market for Little LEO services as a complement to the services provided by the "c" firms.

simplification and, to the extent that these assumptions are not correct, the consumer welfare gains

from entry by one or more new Little LEO suppliers would be larger than those calculated below.

VI. MEASURING CONCENTRATION AND THE EFFECT OF ENTRY ON COMPETITION

The analysis in Table 1 allows us to break down markets into three broad groups: markets

where a new entrant would effectively be providing a new service, markets where a new entrant

would significantly increase competition, and markets where the entry of another Little LEO supplier

would be likely to have significantly lesser effects on prices paid by consumers , if any, because of

the presence of low-cost (non-Little LEO) systems. The first two groups can be called "Little LEO

markets", since non-Little LEO system suppliers would be unlikely to be present in those markets

if one or more Little LEO systems were already active in those markets. *Table 3: Numbers of New-*

Service, Other Little LEO and Competitive-Niche Markets identifies,

Table 3: Numbers of New-Service, Other Little Leo and Competitive-Niche Markets

			New Service (NS)	Other Little Leo (OLL)	Niche - Competitive (N-C)	Total
Global	< 5 minutes		21	0	0	21
	>5&<30 min.		19	2	0	21
	>30 min.& < 3 hr.		0	20	0	20
Nationwide: Ubiquitous	< 5 minutes		21	0	0	21
	>5&<30 min.		0	0	19	19
	>30 min.& < 3 hr.		0	20	0	20
Nationwide: non-Ubiquitous	< 5 minutes		0	0	19	19
	>5&<30 min.		0	0	19	19
	>30 min.& < 3 hr.		0	0	18	18
Urban/ Pockets of Coverage	< 5 minutes		0	0	19	19
	>5&<30 min.		0	0	19	19
	>30 min.& < 3 hr.		0	0	18	18
TOTAL			80	44	112	236

by type of geographic coverage and timeliness of transmission, the number of new service Little

LEO markets (designated NS), the number of other Little LEO markets with incumbent presence

(designated OLL), and the number of markets where significant competition could be expected from

non-Little LEO systems, with the main potential for a Little Leo system being to address niches in

these markets (designated N-C).

A.   New Services Markets

Of the 236 markets identified in Table 1, 80 of those markets would not be served by any of the incumbent Little LEO systems under their current licenses. These markets are characterized by (a) a high valuation on timeliness of transmission and (b) broad (global or nationwide) geographic coverage. The only alternative non-Little LEO potential supplier in those markets will be a Big LEO System with costs significantly higher (*i.e.*, an "m" designation) than those of Leo One USA, so that, in these markets, Leo One USA will either be providing an entirely new service or will allow a large reduction in price (and/or increase in quality) to consumers. It is in these markets that the gain to consumers will be the most certain and potentially the greatest (the largest increase in consumer surplus, assuming, as appears to be the case, that the new entrant could not first-degree price discriminate) and, since these will also be the most profitable markets to enter, it is to these markets that the new entrant can be expected to first allocate its available capacity.[14]

Since the proposed Big LEO systems are the only systems that are technically capable of providing services in many of the markets that are most critical to this analysis (markets requiring global or nationwide coverage and very short outages), it is important to note that there are several considerations that are likely to severely limit the extent to which Big LEOs can be relied upon as a competitive force in those markets.

---

[14]   Since Little LEOs have high fixed cost (though not necessarily high sunk costs, given the relatively short life of a LEO satellite) and low marginal costs, it is important to have markets which generate net revenues that can cover all or a large part of those fixed costs, since only then can the new entrant survive vigorous competition in the other Little LEO markets where ORBCOMM or others are present. If revenue from new-service and competitive markets comes close enough to covering non-sunk fixed costs, then ORBCOMM will not be able to use strategic or predatory pricing to deter the new entrant from replacing its constellation of satellites. More generally, if the new entrant can cover much or all of its fixed costs from net revenues in these markets, it would appear more likely to "play Bertrand" (vigorously compete in price) in the other Little LEO markets.

19

The first consideration is the heterogeneous nature of the four proposed Big LEO systems listed in Table 2. Of the four proposed Big LEO systems, three (ICO, Iridium and Odyssey) are designated as "high cost" (h) in Table 2 on the basis of their high cost of subscriber equipment and cost of service. Only one, Globalstar, is designated as "medium" cost (hence the designation m/h for Big LEO in Table 1).[15] Thus, in contrast to markets where multiple low-cost suppliers could be expected from a single type of technology (*e.g.*, broadband PCS), competition from even a low-cost Big LEO system would at best result in a duopoly market structure in new-service markets.

Second, even if a Big LEO system faced relatively low incremental costs in serving these markets, the opportunity cost of spectrum to a Big LEO system is likely to be too high for it to compete effectively in markets served by Little LEOs. Thus, barring significantly lower demand than anticipated, or other reasons for major excess capacity among Big LEOs, even a system such as Globalstar is unlikely to find it profitable to become a significant competitor in the markets in which Little LEO systems are likely to enter.[16]

---

[15] ORBCOMM's Offering Statement states that:

> The ORBCOMM System uses a packet-switched communications protocol....The Company believes this design will provide ORBCOMM with a substantial cost advantage versus the communications protocols to be used by the proposed Big LEO systems such as Iridium and Globalstar. Unlike the ORBCOMM System, Big LEO systems, which are designed primarily for two-way traffic, are required to establish a circuit-oriented connection over their network to transmit even short messages, which significantly increases the per-message transmission cost for short messages. (ORBCOMM, p.34)

[16] Information as to the true level of demand for Big LEO services is also likely to become apparent before multiple systems are launched, and perhaps even before the first is fully deployed. Since about half the cost of the system is launch costs, even a system with satellites already built could still find it profitable not to proceed if demand projections implied massive excess capacity.

Third, even if a Big LEO system faced massive capacity, so that the opportunity cost of spectrum used to compete in Little LEO markets fell to zero, the marginal cost to the consumers would remain high because the cost of subscriber equipment. Furthermore, a significant investment is required by the Big LEO to create a data product line and service it. If after launching enough of the constellation to begin offering voice service a Big LEO determined that its primary market was not adequate to create the expected return on investment it would still have to make an additional investment to enter the data product markets. Investors tolerance for additional investment at this point may be low. A data market alone is not able to support the high infrastructure costs of a Big LEO system. This additional investment would be required knowing that the rest of the constellation will probably not be launched. Customers are unlikely to invest in long term data product solutions from a Big LEO if it becomes clear that replacement satellites will not be launched after the initial constellation expires at the end of its five year life. Similarly, manufacturers will not have the confidence to invest in developing CPE.[17]

Fourth, there are significant quality differences between the service supplied by Big versus Little LEOs. As ORBCOMM points out in its August 2, 1996 Offering Memorandum:

> The ORBCOMM System has been granted FCC approval to use radio frequencies (that) are located just above those used for FM radio broadcasts and just below those used for VHF Marine push-to-talk radios. By contrast, all of the Big LEOs are currently planned to be licensed in frequencies above 1 GHz. The Company believes that the use of its allocated frequencies will provide significant advantages for packet messaging and data services compared to the use of frequencies above 1 GHz including: (1) lower power requirements to

---

[17] Big LEO and Little LEO systems require completely different and incompatible subscriber equipment. Thus, Big LEO systems cannot serve Little LEO customers that already have Little LEO subscriber equipment at zero marginal cost.

achieve acceptable link margins.....(2) better signal penetration..etc (ORBCOMM, p.36)

Fifth (and finally), even Big LEO systems themselves do not regard Little LEOs as likely significant competitors. Although ORBCOMM was well know at the time of their Form S-1 Registration Statement filed with the SEC on November 29,1994, Globalstar's Statement makes no mention of any Little LEO. In its section on "Demand" factors, Globalstar reports that:

> Globalstar's most direct competitors are the other MSS applicants: ..Iridium..Odyssey, and Ellipso. (Globalstar, p. 15)

The Globalstar Statement also mentions two possible MEO systems, AMSC and Inmarsat, but no Little LEOs.

Similarly, Iridium's July 14, 1995 Form S-1 Registration Statement with the SEC states that:

> The Company believes that its most likely direct competition will come from one or both of the other two licensed MSS applicants --- ..Globalstar,...Odyssey...and the planned Inmarsat-P telecommunications service. It is also possible that the Company could face competition in the future from the MSS applicants that did not receive FCC licenses in January 1995 -- Constellation,..MCHI,...and AMSC, and from systems proposed by Teledesic,...Hughes,....and Cyberstar. (Iridium, p. 57)

B.   Highly Concentrated (or Monopoly) "Other Little LEO" Markets

In another 44 markets, one or more incumbent Little LEO systems, as licensed, would be the low-cost provider(s). In these "other Little LEO markets," new entry would result in a significant decrease in concentration and could be expected to lead to significant price decreases and thus benefits to consumers. Estimates of the amount of the gain to consumers in these markets would depend on the oligopoly model assumed and on the size of the decrease in concentration, which in turn is highly sensitive to the various licensing alternatives under consideration by or

proposed to the FCC. The expected effect on prices and on consumers from new entry would also depend significantly on how VITA could be expected to operate, and on the likelihood that the GE Starsys system will be implemented.

Table 4: HHI analysis calculates the HHI in these "other Little LEO markets" under combinations of four potential licensing outcomes and four potential combinations of roles for GE Starsys and VITA. The first column assumes that Orbcomm, GE Starsys and VITA each fully deploy their licensed systems, and all compete in these markets. Capacity of each system is measured in "current Orbcomm equivalent units," and the HHI is calculated as the sum of the squares of the percentage shares of total capacity assigned to each system. The first row assumes capacity equal to current licensed capacity, with three suppliers, a total capacity of 1.31 "units", and an HHI of 6239. The second row assumes that no new licensing occurs, and Orbcomm's second round amendment is accepted, increasing Orbcomm's capacity to 1.16 units, total capacity to 1.47 units, and the HHI to 6558. The third row assumes that three additional licenses are awarded as proposed in Systems 1, 2, and 3 by the NPRM, resulting in an increase in total capacity to 2.36 units and a decrease in the HHI to 3175. Finally, the fourth row assumes that two additional licenses are awarded for System A and B as proposed by Leo One, resulting in a increase in total capacity to 3.13 units and a further fall in the HHI to 2784.

The second column recalculates the system capacities and HHIs under the assumption that VITA would not compete with other Little LEO suppliers in these markets, but would instead concentrate its efforts in specialized markets which for-profit firms would be unlikely to wish to enter, especially in competition with a non-profit supplier. Column three assumes that GE Starsys fails to launch its system, exits, or otherwise fails to compete effectively and survive in these

TABLE4: HHI Analysis

Potential Licensing Outcomes

1 Today's environment

Licensee	Orbcomm, Starsys & VITA each fully deploy licensed systems			VITA operates in specialized non-for-profit market			Starsys fails to launch its system			Neither VITA or Starsys participate in the market		
	Capacity	Market Share	HHI	Capacity	Market Share	HHI	Capacity	Market Share	HHI	Capacity	Market Share	HHI
Orbcomm	1	76.51%	5854	1	80.00%	6400	1	94.61%	8951	1	100.00%	10000
Starsys	0.25	19.13%	366	0.25	20.00%	400	0	0.00%	0		0.00%	0
VITA	0.057	4.36%	19	0	0.00%	0	0.057	5.39%	29		0.00%	0
	1.31		6239	1.25		6800	1.06		8980	1.00		10000
Market Concentration			6239			6800			8980			10000

2 No new licensing, Orbcomm 2nd round ammendment is accepted.

Licensee												
	Capacity	Market Share	HHI	Capacity	Market Share	HHI	Capacity	Market Share	HHI	Capacity	Market Share	HHI
Orbcomm	1.16	79.07%	6253	1.16	82.27%	6768	1.16	95.32%	9085	1.16	100.00%	10000
Starsys	0.25	17.04%	290	0.25	17.73%	314	0	0.00%	0		0.00%	0
VITA	0.057	3.89%	15	0	0.00%	0	0.057	4.68%	22		0.00%	0
	1.47		6558	1.41		7083	1.22		9107	1.16		10000
Market Concentration			6558			7083			9107			10000

3 Three additional licenses awarded as proposed in Systems 1, 2, & 3 by the NPRM.

Licensee												
	Capacity	Market Share	HHI	Capacity	Market Share	HHI	Capacity	Market Share	HHI	Capacity	Market Share	HHI
Orbcomm	1	42.30%	1789	1	43.35%	1879	1	47.30%	2238	1	48.61%	2363
Starsys	0.25	10.58%	112	0.25	10.84%	117		0.00%	0		0.00%	0
VITA	0.057	2.41%	6		0.00%	0	0.057	2.70%	7		0.00%	0
System 1	0.057	2.41%	6	0.057	2.47%	6	0.057	2.70%	7	0.057	2.77%	8
System 2	0.84	35.53%	1263	0.84	36.41%	1326	0.84	39.74%	1579	0.84	40.84%	1668
System 3	0.16	6.77%	46	0.16	6.94%	48	0.16	7.57%	57	0.16	7.78%	61
	2.36		3175	2.31		3328	2.11		3831	2.06		4039
Market Concentration			3175			3328			3831			4039

4 Two additional licenses awarded as proposed in System A & B by Leo One USA.

Licensee												
	Capacity	Market Share	HHI	Capacity	Market Share	HHI	Capacity	Market Share	HHI	Capacity	Market Share	HHI
Orbcomm	1	31.98%	1023	1	32.57%	1061	1	34.76%	1208	1	35.46%	1257
Starsys	0.25	7.99%	64	0.25	8.14%	66		0.00%	0		0.00%	0
VITA	0.057	1.82%	3		0.00%	0	0.057	1.98%	4		0.00%	0
System A	0.9	28.78%	828	0.9	29.32%	859	0.9	31.28%	979	0.9	31.91%	1019
System B	0.92	29.42%	866	0.92	29.97%	898	0.92	31.98%	1023	0.92	32.62%	1064
	3.13		2784	3.07		2885	2.88		3213	2.82		3340
Market Concentration			2784			2885			3213			3340

markets.[18] Finally column four assumes that neither VITA nor GE Starsys are effective competitors in these markets.

As Table 4 shows, even assuming that the GE Starsys system will be viable and that VITA competes with the for-profit systems, these markets would already be highly concentrated with only first round licensees, with an HHI (the Herfindahl-Hirschman Index calculated from capacity-based shares, which is the preferred measure of concentration where differentiation -- within each of the 44 markets -- is slight) of at least 6239. If the remaining NVNG MSS capacity were assigned to first round licensees (or, equivalently, if first round licensees were allowed to compete in an auction) the HHI in these markets would rise to at least 6558 (an increase of 5%). In contrast, if two additional licenses for efficiently configured and sized systems are assigned to new entrants, as proposed by Leo One USA, the HHI would fall significantly, to at least 2784 (a decrease of 53%). Under a less optimistic set of assumptions (*i.e.*, VITA operates in a specialized not-for-profit market, and GE Starsys fails to launch its system) the HHI in these markets will remain at 10,000 if the available remaining capacity were assigned to ORBCOMM (or, equivalently, if ORBCOMM were allowed to compete in an auction), and would fall to 3340 (a decline of 67%) if, as proposed by Leo One

---

[18]   The potential limitations of GE Starsys as an effective competitor are noted in Orbcomm's Offering Memorandum:

> Starsys employs code division multiple access ("CDMA") modulation (spread spectrum) that must operate in spectrum that is allocated on both a "primary" and "secondary" basis to Little LEO services. As a result, Starsys will operate at lower power levels to avoid interference to other services. The low power rate results in a maximum transmission rate of 600 bps from Subscriber Communications compared with 2,400 bps for the ORBCOMM System. In addition, the U.S. Government has imposed a channel occupancy limit on Starsys of 25% of that permitted for the ORBCOMM System to prevent interference to existing U.S.Government systems. The Company believes that no operational Starsys satellites will be launched until 1997 at the earliest, and that completion of the network will not be accomplished before 2000. (ORBCOMM, p.49)

USA, two additional licenses for efficiently configured and sized spectrum are allocated to entrants. While the effects of changes in concentration on prices depends on a number of factors, the significance of these changes in the HHI can be seen by observing that, under a widely used oligopoly model in industrial organization (the Cournot model), percentage price changes would, because of the very high share of fixed costs in this industry, be close to the percentage changes in the HHI.[19]

In markets where the incumbent would be a monopolist, new entry could be expected to result in a very large price decrease, with the amount depending on the oligopoly model or "game" (collusion, Cournot, Bertrand) assumed or expected, and the relative capacities of the two firms. Only if the incumbent and the new entrant would collude perfectly -- a highly unrealistic assumption -- would there be no gain to consumers. At the other extreme, if the incumbent and the new entrant "played Bertrand" (competition in prices), then the price would fall to marginal cost, generating a very large increase in consumer surplus. An intermediate result would be expected if the incumbent

---

[19]   These HHI levels and differences would clearly violate the *Guidelines* if this were a merger. In other words, if the spectrum were granted to Leo One USA, the FTC or DOJ could be expected to attempt to block any subsequent merger between Leo One USA and either ORBCOMM or GE Starsys, at least absent a failing company defense or a showing of overpowering efficiencies unique to the merger. Under the *Guidelines*:

> Mergers producing an increase in the HHI of more than 50 points in highly concentrated markets (HHI >1800) post-merger potentially raise significant competitive concerns...Where the post-merger HHI exceeds 1800, it will be presumed that mergers producing an increase in the HHI of more than 100 points are likely to create or enhance market power or facilitate its exercise.(*Guidelines*, pp 30-31).

and the new entrant were equally sized and "played Cournot" (competition in quantities), in which case price could fall by one third.[20]

In markets where the market structure from the first processing round would be a duopoly, the price decrease following entry could also be quite large, but under different conditions. Now, if the incumbent duopolists played Bertrand, the price decrease would be zero, since the current duopoly price would already be the competitive price. Similarly, if the incumbent duopolists colluded and all three firms continued to collude after entry, price would remain at the monopoly level, and the price decrease would be zero. At the other extreme, if two Little LEOs would collude

---

[20]   In a Cournot market with linear demand and constant marginal cost, the market price, as a proportion of the monopoly price, is given by (for a derivation, see Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization*, Scott, Foresman, 1990, p.267):

$$P-MC = 2/(N+1)$$
where:

P   = market price in a Cournot market,
MC = marginal cost, and
N   = number of equal sized suppliers
which, in an industry with zero marginal cost, reduces to:
$$P = 2/(N+1)$$
Thus, in such a market, a market with one supplier would have a price of 1.0; a market with two suppliers would have a price of 2/3 (so that the entry of the second firm would result in a 33% price decrease); a market with three firms would have a price of ½ (so that the entry of the third firm would result in a further 25% price decrease), etc.

This relationship can be expressed in terms of the HHI by defining the "numbers equivalents" as:

$$N^* = 10,000/HHI$$

so that the market price, as a proportion of the monopoly price, can be restated as:

$$P-MC = 2 \ HHI \ /(HHI + 1)$$

which, in an industry with zero marginal cost, reduces to:

$$P = 2 \ HHI \ / \ (HHI + 10,000)$$

For an application of this approach, see Section VII, below.

26

(perhaps by allocating markets and not entering into each other's assigned markets), but collusion would break down completely with a third supplier, prices could fall to marginal cost, generating very large gains to consumers. Again, an intermediate result would be expected if all suppliers play Cournot, with substantial gains to consumers since the HHI would fall significantly: moving from two to three equal sized competitors, for example, would result in a further 25% fall in price.

C.   Relatively Competitive Niche Markets

In the remaining 112 markets identified, Little LEO systems would face effective competition from other multiple suppliers of several types of systems, notably cellular, broadband PCS and SMR, as well as terrestrial data system suppliers such as Cellnet and CDPD. Entry of second round licensees into these markets can thus be expected to be the lowest priority use for their available capacity, as well as affecting prices the least and generating the lowest amount of benefit to consumers.

Even though existing and proposed terrestrial data networks would provide effective competition for Little LEO systems in urban areas, it is possible that purchasers of services in those areas may select Little LEO systems for service. For example, Company A provides vending machine services in 20 markets throughout the southeast. The Company decides to contract with a wireless data service provider to monitor the Company's machines for product outages and mechanical status. While each market has multiple wireless data providers, no single provider offers service in all 20 markets. Company A may prefer to subscribe to services from a Little LEO provider that can provide connectivity to the vending machines in all 20 markets, thus increasing the efficiency of the company's back office operations.

27

D.   <u>Revenue Shares from New-Service, Little Leo, and Competitive Markets</u>

Given that any new entrant can be expected to allocate system capacity into its most profitable use, it is not surprising that Leo One's revenues are expected to come disproportionately from new-service and Little LEO markets. As *Table 5: Expected Leo One USA Revenue Distribution Across New-Service, Other Little LEO and Competitive-Niche Markets* shows, new-service markets account for 32% of the number of markets but are expected to generate 60% of revenue. Little LEO markets account for 17% of the number of markets, but are expected to generate 26% of revenues. And competitive markets, which account for 44% of the number of potential markets, are expected to account for only 14% of Leo One USA's revenues.

VII.   THE EFFECT OF ENTRY AND CHANGES IN CONCENTRATION ON PRICES AND ON THE WELFARE OF CONSUMERS

These data, when combined with some simple but not unrealistic -- even conservative -- assumptions, are sufficient for us to derive a rough, "back of the envelope" estimate of the gain to consumers (the increase in consumer surplus) that would result from the entry of Leo One USA's proposed System A and System B. For example, assuming linear demand curves in all markets; all costs fixed (*i.e.*, zero marginal cost); Cournot-type behavior in oligopoly markets; VITA competing in for-profit markets and GE Starsys successfully launching its system; the entry of Leo One USA and a second new entrant; only one new entrant entering into "new service" markets; and no effect at all on prices in "competitive-niche" markets from the System A or the System B supplier's entry into those markets, the estimated increase in consumer surplus in year five from new entry would be 50% of Leo One USA's anticipated year-five revenue of $ 295 million from new service markets and approximately 236% of Leo One USA's year-five anticipated revenue of $126 million from

TABLE 5: LEO ONE EXPECTED REVENUE, YEAR 5, BY MARKET

Market Analysis Summary
$ Revenue (millions)

	Tracking	Monitoring	Emergency Services	Messaging	Transaction Services		Total	% of Total
"NS" Markets	151.1	10.2	40.3	92.9	0.8		295.3	60%
"OLL" Markets	64.8	21.4	0.0	39.8	0.0		125.9	26%
"N-C" Markets	36.5	8.9	7.0	14.7	0.1		67.2	14%
Total	252.4	40.5	47.3	147.4	0.9		488.5	100%

"Other Little Leo" markets, plus 0% of Leo One USA's anticipated revenue of $ 67 million from "competitive-niche" markets, for a total increase in consumer surplus of $ 444 million, or 91% of Leo One USA's anticipated total revenue.

This derivation is shown in *Table 6: Effect of Leo One Proposal on Consumer Surplus* and is illustrated in *Figure 1: New-Service Markets, Figure 2: Other Little LEO Markets* and *Figure 3: Competitive-Niche Markets*. Table 6 begins, for three situations (new service markets after entry, other Little LEO markets before entry, and other Little LEO markets after entry) with the HHI in that market (see Table 4), calculates the number equivalent (N), and determines the quantity (Q), market price (P) and amount of consumer surplus (CS) in that market, assuming linear demand and zero marginal costs.[21] Assuming market shares for System A of 100% in new-service markets and 29% in other Little LEO markets (System A's share of capacity from Table 4), and using the estimates of Leo One's expected revenue in five years (from Table 5), we can derive the expected level of consumer surplus in these three markets in year 5. The total increase in consumer surplus from entry ($ 444 million) is then equal to the consumer surplus in new-service markets ($ 148 million) plus the difference between the pre-entry and post-entry consumer surplus in other Little LEO markets ($ 297 million).

Figures 1-3 illustrate the effect of entry in the three market types: new service, other little LEO, and niche- competitive. Figure 1 illustrates the effect of entry by one new provider into a new service market with a linear demand curve and zero marginal cost. Under these assumptions, quantity (Qns) is one half the quantity that would be demanded if price (Pns) equaled marginal cost,

---

[21]   See footnote above. For the derivation of the formulas in Table 6, see Carlton and Perloff (1990), p.267

29

TABLE 6: EFFECT OF LEO ONE PROPOSAL ON CONSUMER SURPLUS

	HHI	N	Q	P	CS	Rev Leo	Ratio, CS to Rev. Leo1	Leo1 Rev. in Year 5	CS in Year 5
New Service Market	10,000	1.00	1.00	1.00	0.50	1.00	0.50	295	148
OLL Market, current	6239	1.60	1.23	0.77	0.76	0.00	0.00	0	484
OLL Market, Leo 1 Proposal	2784	3.59	1.56	0.44	1.22	0.20	6.19	126	780
LL Market, Leo One Proposal									
minus OLL Market, current	-3455	1.99	0.33	-0.33	0.47				297
Total CS Increase									
Leo1 from current									444

$N = 10,000/HHI$

$Q = 2N/(NH)$

$P = 2/(N+1)$

$CS = 2N^2/(N+1)^2$

Rev Leo 1 = (Market Share Leo 1) PQ
   MS Leo 1: Current = 0
   MS: Leo 1: Leo One Proposal = 0.29
       (from Table 4)
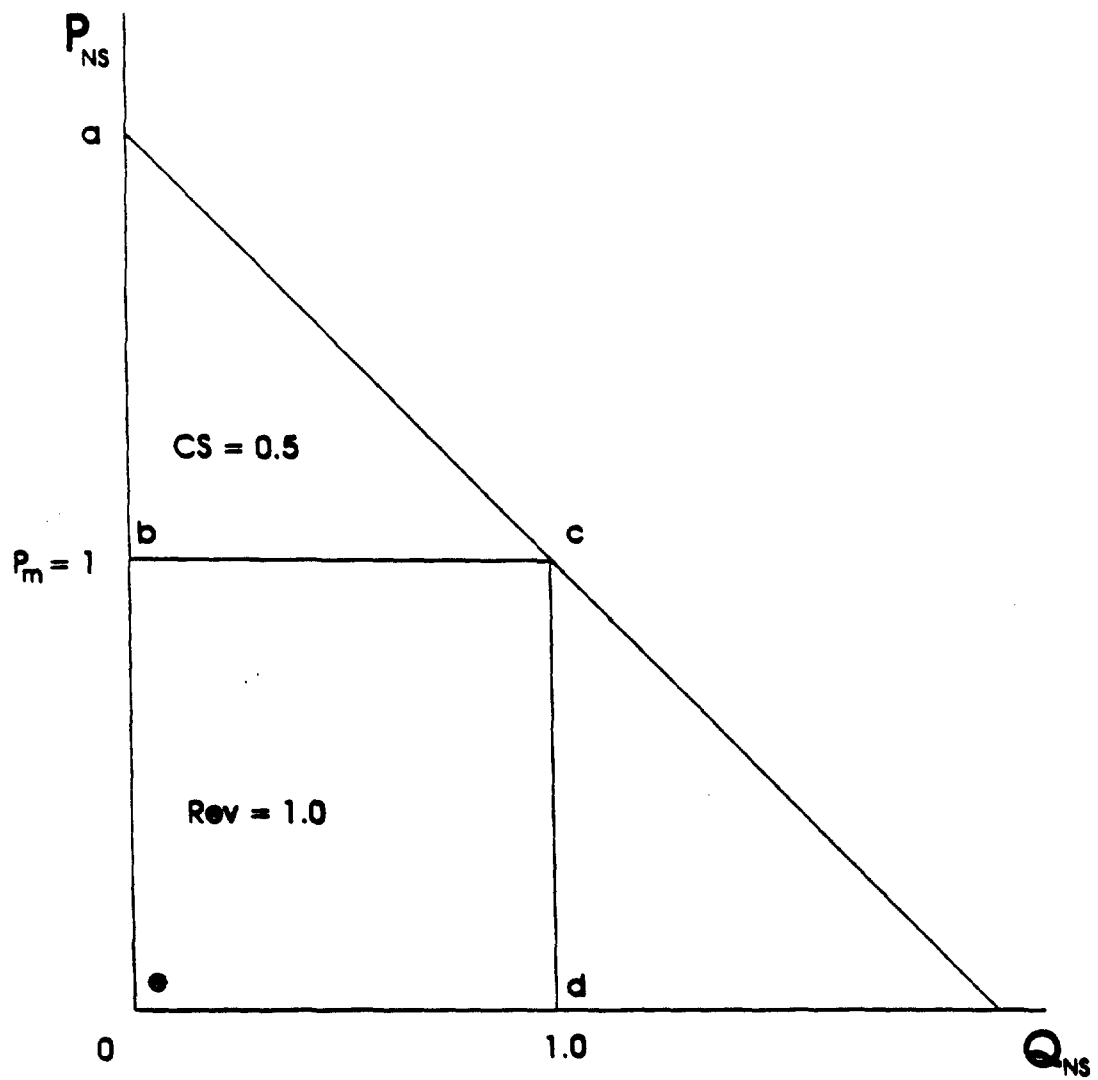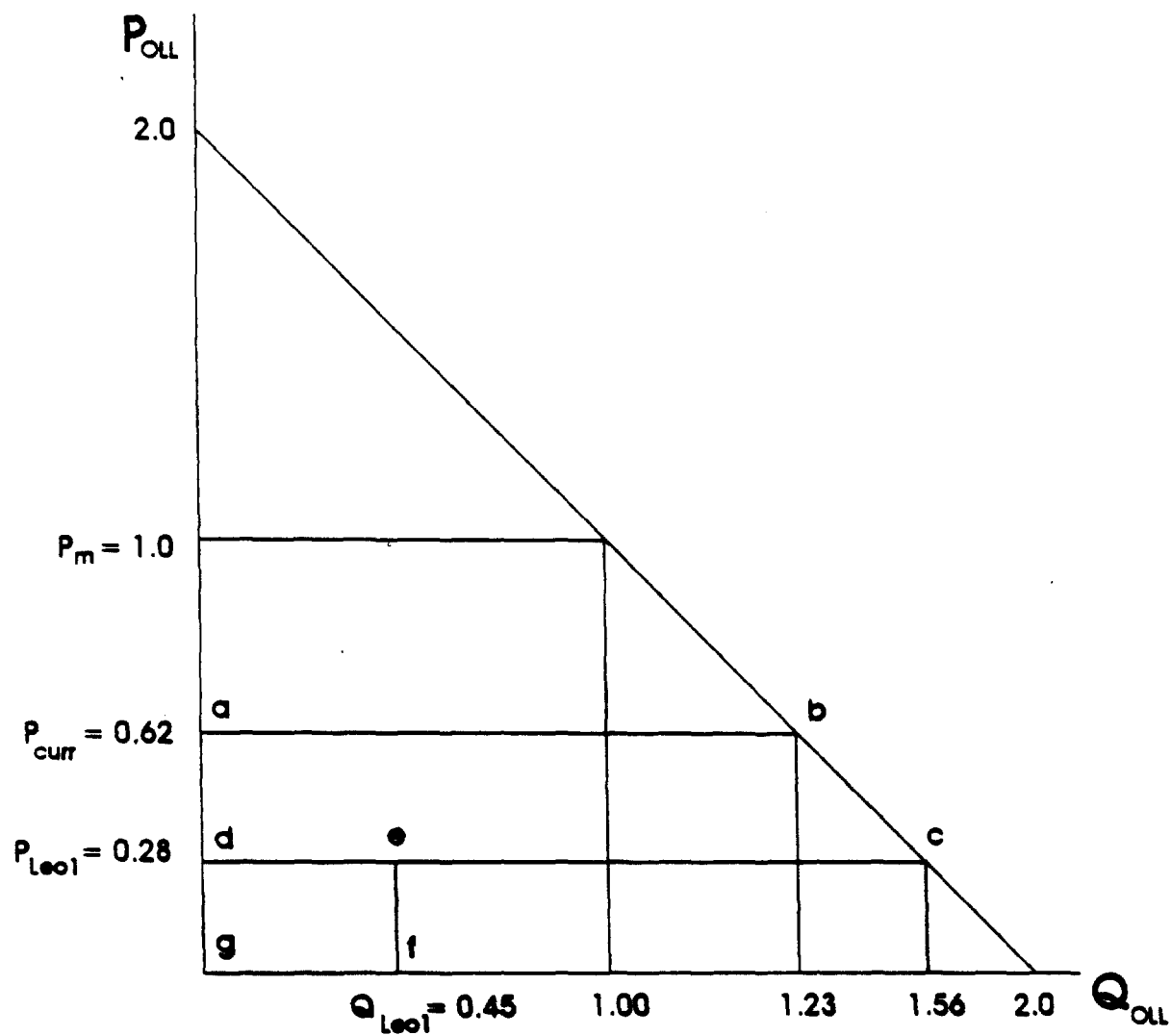
Figure 1: New Service Market

Figure 2: Other Little Leo Market

Figure 3: Competition - Niche Market